Amendments to the Specification:

Please replace the paragraph on page 1, line 14 with the following amended paragraph:

Echo is a significant factor in the perceptual quality of an end-to-end telephone link during a telephone call. The influence of ~~said~~ that factor on the perception may be quantified by measuring the combination of a pair of parameters known by the indications "talker echo loudness rating" and "round-trip delay", such as defined, e.g., in the Recommendation G.107 of ITU-T (Reference [1]; for more bibliographical details relating to the references, see Section C below ~~under D~~.). For a non-intrusive measurement for determining such parameters, ITU-T Recommendation P.561 (see Reference [2]) provides recommendations. ~~Said~~ This known technique, however, has the following drawbacks. To measure the influence of ~~the~~ an echo disturbance, first of all, a correlation technique is required to determine the delay of the echo. Furthermore, a specific algorithm is required for estimating the "talker echo loudness rating". Moreover, determining the echo delay is difficult when the echo signals are of a low level, i.e., when they are located near the limit of perceptibility, as often is the case with speech on high-quality telephone links. Even if a correct estimate is made of the delay and the loudness, ~~even~~ then ~~the~~ differences in perception of the echo disturbance between different talkers ~~are~~ may not be capable of being measured, ~~since~~ because during the measurement no details of the speech signal can be taken into account. Furthermore, effects caused by a distortion of the sidetone signal cannot be taken into account either. Therefore, the known technique

~~shows up~~ produces only a moderate correlation between ~~the~~ objective measurement results and ~~the~~ more subjective findings of the talkers, particularly in the event of slight echo disturbances and/or sidetone distortions.

Please replace the paragraph on page 2, line 1 with the following amended paragraph:

In fact, in the event of echo on a telephone link between an A subscriber and a B subscriber, a distinction must be made between a so-called talker echo (from A to A) which the talker at the transmission side (A) may experience during conversation, and a listener echo, which the listener at the receiving side (B) may experience while listening. The perception of the influence on the listener of the listener echo, which in fact consists of twice-reflected speech signals, may basically be quantified using a so-called objective measurement technique, such as the Perceptual Speech Quality Measure (PSQM). With ~~said~~ this known technique (see, e.g., references [3] and [4]), which models the perceptual properties of human hearing, the listening quality of a one-way speech signal over a telephone link may be predicted. Quantifying the influence of echo and/or sidetone distortion on the perception of the talker using ~~said~~ this technique, i.e. measuring the talking quality, however, is not known and up to now not possible ~~just like that~~, but it is desirable.

Please replace the paragraph on page 2, line 22 with the following amended paragraph:

References [6], [7] and [8] disclose telephone-link circuits which include echo-~~minimising~~minimizing devices, such as echo ~~cancelors~~ cancellers and echo suppressors, for various kinds of echo, such as acoustic echo caused by acoustic reflections in a teleconferencing room of a teleconferencing system (reference [6]), a so-called electrical echo caused in a four-to-two wire conversion in a PSTN/subscriber interface (reference [7] and [8]), and an acoustical/mechanical type of echo caused in the acoustical and mechanical coupling of the loudspeaker and the microphone in a telephone (hand)set (reference [8]). Such echo-~~minimising~~minimizing devices are usually applied as near as possible to the origin of the echo signal in question in the telecommunication network. A perceptual quality measurement of any talking quality as indicated above is not disclosed at all.

Please replace the paragraph on page 2, line 37 through page 3, line 2 with the following amended paragraph:

The object of the invention is to provide for a method and a device for measuring the talking quality, i.e. the influence of returned signals such as echo and/or sidetone distortion on the perceptual quality on the part of the talker of a telephone link in a telecommunications network, which both does not possess ~~said~~ the drawbacks of the known technique and accommodates ~~said~~ the desire.

Please delete the paragraphs on page 3, lines 5 and 8 in their entirety:

~~A method for measuring the talking quality of a telephone link in a telecommunications network according to the preamble of claim 1, according to the invention is characterised as in claim 1.~~

~~A device for measuring the talking quality of a telephone link in a telecommunications network according to the preamble of claim 12, for the definition of which reference [4] was applied, according to the invention is characterised as in claim 12.~~

Please replace the paragraph on page 3, line 12 with the following amended paragraph:

The invention is based on the insight that a talking telephone user simultaneously listens and therefore hears his own speech signal simultaneously with an echo of his speech and any other signals possibly returning from the headphone of the telephone set. Therefore, the application of an original speech signal, i.~~e~~e. a talker speech signal, and a combined signal, composed of the original talker speech signal and a corresponding returned signal, as input signals for an objective perceptual quality measurement technique of speech signals, such as PSQM, may lead to a usable estimate of the talking quality, whereas such is not the case if only the original talker speech signal and the corresponding echo or any other corresponding returned signal are used. In this way, any distortions in either the echo or the sidetone can also be taken into account in the prediction of the talking quality.

Please delete the paragraphs on page 3, lines 26 and 32 in their entirety:

~~A telephone link circuit for a telephone link in a telecommunications network, comprising a forward channel and a return channel, and an echo minimising device included between the forward channel and the return channel, for the definition of which reference [8] was applied, according to the invention is characterised as in claim 17.~~

~~Further preferred embodiments of the method, the device and the telephone link circuit of the invention are summarised in the various subclaims.~~

Please replace the paragraph on page 4, line 11 with the following amended paragraph:

All references are ~~considered to be~~ incorporated <u>by reference</u> into the present application.

Please replace the paragraph on page 4, line 37 through page 5, line 9 with the following amended paragraph:

FIG. 1 shows a known schematical setup of an application of an objective measurement technique, such as, e.g., the one based on a model of the human hearing and which is usually designated by PSQM, for estimating the perceptual quality of speech over telephone links. It comprises a system or telecommunications network under test 10, hereinafter referred to as network 10 for ~~briefness' sake~~<u>the sake of brevity</u>, and a system 12 for the perceptual analysis of speech signals offered, hereinafter designated, ~~for briefness' sake only~~<u>again for the sake of</u>

brevity, by PSQM system 12. A speech signal d(t) is used, on the one hand, as an input signal of the network 10 and, on the other hand, as a first input signal of the PSQM system 12. An output signal d'(t) of the network 10, which in fact is the speech signal d(t) affected by the network 10, is used as a second input signal of the PSQM system 12. An output signal p(t) of the PSQM system 12 represents an estimate of the perceptual quality of the speech link through the network 10. Since the input end and the output end of a speech link, particularly in the event it runs through a telecommunications network, are remote from each other, then~~,~~ for the input signals of the PSQM system use is made in most cases of speech signals stored on data bases. Here, as is customary, speech signal is understood to mean each sound basically perceptible to the human hearing, such as speech and tones. The system or network being tested may, of course, also be a simulation system, which simulates a telecommunications network. With this known technique, reliable estimates of the perceptual quality are possible.

Please replace the paragraph on page 5, line 10 with the following amended paragraph:

FIG. 2 schematically shows a telephone link established between an A subscriber and a B subscriber of a telecommunications network 20. Telephone sets 21 and 22 of the A subscriber and the B subscriber, respectively, are connected by way of two-wire connections 23 and 24 and four-wire interfaces, namely, hybrids 25 and 26, to the network 20. Through the network, the established telephone link has a forward channel including a two-wire part, i.ee.

two-wire connections 23 and 24, and a four-wire part 27, over which speech signals from the A subscriber are conducted, and a return channel including a two-wire part, i.e~~e~~. two-wire connections 24 and 23, and a four-wire part 28, over which speech signals from the B subscriber are conducted. An acoustical speech signal s striking the microphone M of the telephone set 21 of the A subscriber, is passed on, by way of the forward channel (23, 27, 24) of the telephone link, to the earphone R of telephone set 22, and becomes audible there for the B subscriber as an acoustical speech signal s″ affected by the network. Each speech signal s(t) on the forward channel generally causes a returned signal r(t) which, particularly due to the presence of ~~said~~ the hybrids, includes an electrical type of echo signal on the return channel (28, 23) of the telephone link, and this is passed on to the earphone R of the telephone set 21, and may therefore disturb the A subscriber there. Furthermore, the acoustic and/or mechanical coupling of the earphone or loudspeaker signal to the microphone of the telephone set of the B subscriber may cause an acoustic type of echo signal back to the telephone set of the A subscriber, which contributes to the returned signal. In an end-to-end digital telephone link (such as in a GSM system or in a Voice-over-IP system) such acoustic echo signal is the only type of echo signal that contributes to the return signal.

Please replace the paragraph on page 5, line 39 with the following amended paragraph:

_____Summarizing, a returned signal r(t) may include, at various stages in the return channel of a telephone link as

caused by a speech signal s(t) in the forward channel of the telephone link:

Please replace the paragraph on page 6, line 9 with the following amended paragraph:

To restrict echo effects in returned signals such as represented by the signals e1 and e2 to a minimum, it is generally customary to include, in telephone-link circuits, echo suppressors or echo cancellers, one at each end of a telephone link. Using the signals present in the forward and return channels, an echo suppressor or canceller continuously makes an estimate of the echo signal and subtracts it from the signal in the return channel. Such an estimate, however, cannot always be carried out reliably, which is particularly the case on high-quality speech links, where the echo signals are at ~~the~~ an audibility limit. At those levels, the optimization ~~The optimisation~~ routines applied within such echo suppressors or cancellers do not always provide the best result concerning the perception. Should such ~~optimisation~~ optimization routines be based, at least in part, on the method described below with reference to FIG. 3, then an optimum result having a minimally perceptible echo is possible.

Please replace the paragraph on page 6, line 24 through page 7, line 14 with the following amended paragraph:

FIG. 3 shows a schematic setup according to the invention, for obtaining an estimate of the perceptual talking quality of a telephone link, for a telephone user

when talking on his own telephone set. In a similar manner as the setup of FIG. 1, the setup of FIG. 3 comprises a system or telecommunications network under test 30, hereinafter, for ~~briefness' sake~~ the sake of brevity, referred to as network 30, and a system 32 for the perceptual analysis of speech signals offered, hereinafter, ~~for briefness' sake~~ again for the sake of brevity, only designated as PSQM system 32. Any talker speech signal s(t) is used, on the one hand, as an input signal of the network 30 and, on the other hand, as first input signal of the PSQM system 32. A returned signal r(t) obtained from the network 30, which corresponds to the input talker speech signal s(t), is combined, in a combination circuit 34, with the talker speech signal s(t) to provide a combined speech signal s'(t), which is then used as a second input signal of the PSQM system. If necessary, the signal s(t) is scaled to the correct level before being combined with the returned signal r(t) in the combination circuit. An output signal q(t) of the PSQM system 32 represents an estimate of the talking quality, i.e. of the perceptual quality of the telephone link through the network 30 as it is experienced by the telephone user during talking on his own telephone set. Here, too, use may again be made of signals stored on data bases. These may be obtained, e.g., from the telephone set (such as signal e4 in the electrical domain or signal e5 in the acoustic domain - see FIG. 2) of the A subscriber in the event of an established link during speech silence of the B subscriber. The hybrid between the telephone subscriber access point and the four-wire interface with the network does not, or hardly, contribute to the echo component in the returned signal r(t) (of course, it does contribute to the echo component in a returned signal

occurring in the return channel of the B subscriber of the telephone link). However, any such signal contribution has a short delay and, as a matter of fact, forms part of the sidetone.

Please replace the paragraph on page 7, line 21 through page 8, line 7 with the following amended paragraph:

FIG. 4 shows, in a similar manner as part of FIG. 2, a two-wire connection 41 which, by way of a four-wire interface, in this case hybrid 43, and of four-wire connection parts 44 and 45, is connected to a telecommunications network 40. Through the network, an established telephone link may be set up having a forward channel via the two-wire connection 41 and the four-wire connection part 44 and a return channel via the four-wire connection part 45 and the two-wire connection 41. The line circuit belonging to the telephone link includes an echo canceller 46. Also included is a PSQM system 42, of which a first input port 47 is coupled to the four-wire part 44 of the forward channel, and a second input port 48 is coupled to an output port 49.3 of a signal combiner 49 having two input ports 49.1 and 49.2 which are coupled to the four-wire part 44 of the forward channel and the four-wire part 45 of the return channel, respectively. An output port 50 of the PSQM system 42 for quality-control purposes may be coupled directly, or by way of a switch 51 (arrows F and G), to a monitoring system (not shown). In addition the output port 50, as shown, may be coupled, by way of the switch 51, to a control input 52 of the echo canceller 46. The switch 51 is preferably controlled by a control signal ~~given off~~ produced by a detection circuit 53 (constructed, e.g., as a

"double-talk" detection circuit known per se), which is coupled to the return channel for detecting the speech status on the four-wire part 45 of the return channel, such as, e.g., speech silence on the part of the B subscriber. Thus, the estimated signal becoming available by way of the output port 50 of the PSQM system may be used, on the one hand, for all kinds of quality-control purposes and, on the other hand, may be used directly in echo-~~minimising~~minimizing equipment.

Please replace the paragraph on page 8, line 8 with the following amended paragraph:

In the most simple embodiments, the combination circuit 34 and the signal combiner 49 are signal adders. When applying the method and the device in practice, in the signal combiner, ~~carrying out~~ the adding function (addition) is preferably preceded by the so-called "inverse~~ly~~ filtering" of one of the signal components. The inverse filter applied there generates a linear estimate of the echo path, and to a major degree contributes towards achieving a high correlation between an objective measurement and a subjective observation.

Please replace the paragraph on page 8, line 17 with the following amended paragraph:

In a further embodiment (not specifically shown), the signal combination of the speech signal s(t) and the returned signal r(t) is carried out in the acoustical domain, e.g. by recording the relevant acoustical signals by means of one or more additional microphones, to the one used

in the telephone handset, near one or both ears of the talking user. In its simplest form the acoustical signal at the non-telephone ear is used as a first input to the PSQM system while the acoustical signal at the telephone ear is used as the second input signal to the PSQM system. In case a so-called head-and-torso-simulator (HATS) is used, the microphones located in the artificial ears of such a HATS can be used. In case only a single microphone is used, the first input signal to the PSQM system can be recorded from the acoustic domain using a reference telephone handset while the second input signal to the PSQM system can be recorded from the acoustic domain using the telephone handset with the network under test. (~~WEGLATEN In this case~~ Note, that in this case, both recordings contain the same natural acoustic~~al~~ sidetone that can be used to align the non-simultaneously recorded signals.)